1996 Cancer in Washington

Annual Report of the
Washington State Cancer Registry

October 1998

Office of Community Wellness and Prevention

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Contents

Executive Summary

This annual report of the Washington State Cancer Registry incorporates cancer incidence data for the entire state. It represents the ongoing effort by the Department of Health, the Fred Hutchinson Cancer Research Center, the Blue Mountain Oncology Program, physicians, and tumor registrars throughout Washington. This report is also available on the Department of Health website at http://www.doh.wa.gov/EHSPHL/Epidemiology/reports.htm.

Cancer is a heterogeneous group of diseases characterized by uncontrolled growth and spread of abnormal cells. The various forms of cancer were responsible for 10,161 deaths among Washington residents in 1996, comprising approximately twenty-five percent of all deaths. In 1996, cancer (all sites combined) was the most common cause of death among adults ages 45 to 74 years and the second leading cause across all age groups. Some form of cancer will likely strike one in three Washingtonians in their lifetime. In 1996, there were 24,286 new cases of cancer diagnosed in Washington.

This report of the Washington State Cancer Registry (WSCR) summarizes information on new cases of cancer (incidence) and death due to cancer (mortality) for Washington state residents. The report provides information on cancer of all sites combined and the 24 cancer sites most frequently diagnosed in Washington residents. This information can be used at the state, county, or regional level to identify the burden of morbidity and mortality associated with each type of cancer. This information, combined with information on cancer prevention, early detection, and treatment, is useful for program planning and policy development aimed at reducing the burden of cancer.

The five most common types of cancer reported among Washington residents during 1996 were breast, lung, prostate, colorectal, and melanoma.

1 4,147 new cases and 785 deaths from female breast cancer were reported in 1996. Breast cancer was the second most common cause of cancer mortality for women. Incidence and mortality rates for Washington women from 1992 to 1996 reflect the national pattern. The rate of new cases of breast cancer is staying the same and the mortality rate from breast cancer is declining. (Wingo et al., 1998) The best strategy for prevention of breast cancer mortality is early detection through screening.

2 3,246 new cases and 638 deaths from prostate cancer were reported for 1996. It was the second leading cause of cancer death among men. Nationally, both incidence and mortality rates for prostate cancer have been decreasing. (Wingo et al., 1998) These trends are also apparent in Washington. The reasons for the decreases are not clear. The recent decrease in incidence may be the result of changes in screening practices in the late 1980s and early 1990s (i.e., the introduction of screening into an unscreened population in the late 1980s followed by a decline in screening in the 1990s). (Wingo et al., 1998)

3 3,193 new cases of lung cancer were reported in 1996. 2,945 Washingtonians died of lung cancer, making it the leading cause of cancer mortality overall for both males and females in that year. Nationally, lung cancer incidence and mortality are decreasing for men and increasing for women. (Wingo et al., 1998) Washington data reflect this pattern for men. The pattern for women reflects the national trend for 1992 to 1995. However, both incidence and mortality rates for lung cancer in women were lower in 1996 than in 1995. Additional years of data are needed to determine whether the rates for 1996 mark a turning point in the earlier pattern of increase. Reduction in smoking remains the major focus of efforts to prevent lung cancer.

4 2,612 new cases of and 1,032 deaths from colorectal cancer were reported in 1996. Nationally, incidence and mortality rates for colorectal cancer are decreasing, but the reason for this pattern is not clear. (Wingo et al., 1998) In Washington the incidence of colorectal cancer declined approximately 2.0% per year between 1992 and 1996. Washington's mortality rates remained constant between 1991 and 1996. Regular screening has been shown to reduce mortality. (NCI, 1998) Regular physical activity and a low fat, high fiber diet rich in fruits and vegetables may reduce the risk for colon and rectum cancer. (ACS, 1998) Heavy use of alcohol and smoking may increase the risk of colorectal cancer. (NCI, 1998)

5 1,418 new cases and 154 deaths from melanoma of the skin were reported in 1996. Trends Washington State are similar the national trends. The incidence of melanoma has been increasing, while mortality since 1990 has remained constant. (Wingo et al., 1998) Avoiding sunburn, especially early in life, is effective in reducing incidence of melanoma. (NCI 1998) The ACS recommends routine examination of the skin for reducing mortality from melanoma. (ACS, 1998)

Preface

This annual report of the Washington State Cancer Registry incorporates cancer incidence data for the entire state. It represents the ongoing effort by the Department of Health, the Fred Hutchinson Cancer Research Center, the Blue Mountain Oncology Program, physicians, and tumor registrars throughout Washington. This information is presented in the hope that it will assist health care providers, public health officials, voluntary organizations, and concerned citizens in their efforts to prevent and control cancer in Washington. This report is also available on the Department of Health website at http://www.doh.wa.gov/ EHSPHL/Epidemiology/reports.htm.

Introduction

Cancer is a heterogeneous group of diseases characterized by uncontrolled growth and spread of abnormal cells. The various forms of cancer were responsible for 10,161 deaths among Washington residents in 1996, comprising approximately twenty-five percent of all deaths. In 1996, cancer (all sites combined) was the most common cause of death among adults ages 45 to 74 years and the second leading cause across all age groups. Some form of cancer will likely strike one in three Washingtonians in their lifetime. In 1996, there were 24,286 new cases of cancer diagnosed in Washington.

Illness and death due to cancer are increasingly preventable through two types of strategies. Primary prevention strategies aim to reduce, usually through lifestyle change, the likelihood that a healthy individual will develop cancer. Alternatively, secondary prevention is accomplished by screening asymptomatic people to diagnose cancers at an early, more readily treatable stage.

This report of the Washington State Cancer Registry (WSCR) summarizes information on new cases of cancer (incidence) and death due to cancer (mortality) for Washington state residents. The report provides information on cancer of all sites combined and the 24 cancer sites most frequently diagnosed in Washington residents. This information can be used at the state, county, or regional level to identify the burden of morbidity and mortality associated with each type of cancer. This information, combined with information on cancer prevention, early detection, and treatment, is useful for program planning and policy development aimed at reducing the burden of cancer.

The Five Most Common Cancer Sites

The most common types of cancer reported among Washington residents during 1996 were breast, lung, prostate, colorectal, and melanoma.

1 4,147 new cases of female breast cancer were reported. Breast cancer is by far the most frequently diagnosed cancer among women. Responsible for 785 deaths in 1996, it was the second most common cause of cancer mortality for women. The National Cancer Institute reports that 1 in 8 women in the United States will develop breast cancer at some point in their lives. (NCI, 1998) Nationally, breast cancer incidence increased approximately 1% per year between 1940 and 1980. The increase was higher in the 1980s, reaching 4% per year between 1982 and 1987. Between 1990 and 1995, however, the national rate of new breast cancer cases stayed the same. (Wingo et al., 1998) The Washington data between 1992 and 1996 follow this national trend. Nationally, mortality from breast cancer has been declining in recent years (Wingo et al., 1998). This trend is also apparent in Washington where mortality from breast cancer decreased an average of 1.6% per year between 1991 and 1996. Most likely, earlier detection of and improvements in treatment for breast cancer are responsible for the decrease in mortality. (Wingo et al., 1998)

Because the cause of most breast cancer is unknown and the known risk factors are not easy to modify, the best strategy for prevention of breast cancer mortality is early detection and treatment. Regular breast cancer screening with mammography and clinical breast exam reduces the number of deaths from breast cancer for women between 50 and 69 years. (NCI, 1998) Experts do not agree on the benefits of mammography screening for women under 50 years old or older than 69 years. However, the American Cancer Society recommends clinical breast exam and mammography every year for women beginning at age 40. (ACS 1998) The National Cancer Institute recommends clinical breast exam and mammography every one to two years beginning at age 40. (NCI, 1998) While evidence about the value of self-breast exam for reducing mortality from breast cancer is inconclusive (NCI, 1998), the American Cancer Society recommends monthly self-breast exams beginning at age 20. (ACS, 1998)

2 3,246 new cases of prostate gland cancer were reported in 1996, making prostate cancer the most commonly reported malignancy among men. It was the second leading cause of cancer death among men, killing 638 men in 1996. Nationally, both incidence and mortality rates for prostate cancer have been decreasing. (Wingo et al., 1998) These trends are also apparent in Washington. The reasons for the decreases are not clear. The recent decrease in incidence may be the result of changes in screening practices in the late 1980s and early 1990s (i.e., the introduction of screening into an unscreened population in the late 1980s followed by a decline in screening in the 1990s). (Wingo et al., 1998) No effective means are currently available to prevent the development of prostate cancer. While the American Cancer Society recommends regular screening for early detection and treatment (ACS, 1998), prostate cancer screening has not demonstrated a clear benefit in reducing mortality. (NCI, 1998)

3 3,193 new cases of lung cancer were reported for 1996. 2,945 Washingtonians died of lung cancer, making it the leading cause of cancer mortality. Nationally, lung cancer incidence and mortality are decreasing for men and increasing for women. (Wingo et al., 1998) Washington data reflect this pattern for men. The pattern for women reflects the national trend for 1992 to 1995. However, both incidence and mortality rates for lung cancer in women were lower in 1996 than in 1995. Additional years of data are needed to determine whether the rates for 1996 mark a turning point in the earlier pattern of increase.

Cigarette smoking is by far the most important cause of lung cancer. Nationally, approximately 90% of male and 72% of female lung cancer deaths are attributed to smoking. (CDC, 1997) Studies provide no evidence that screening can reduce mortality. Reduction in smoking remains the major focus of efforts to prevent lung cancer.

4 2,612 new cases of colon and rectal cancer were reported in 1996. Colorectal cancer was the state's second leading cause of cancer death, resulting in the loss of 1,032 lives in 1996. Nationally, the incidence and mortality rates for colorectal cancer are decreasing. Changes in screening, treatment, and lifestyle may be contributing to this decrease. (Wingo et al., 1998) In Washington, the incidence of colorectal cancer declined approximately 2.0% per year between 1992 and 1996. Washington's mortality rates remained constant between 1991 and 1996.

Regular screening of the stool for invisible amounts of blood beginning at age 45 and regular visual examination of the lower bowel (sigmoidoscopy) beginning at age 50 have been shown to reduce mortality among people diagnosed with colorectal cancer. (NCI, 1998) Research evidence indicates that regular physical activity and a low fat, high fiber diet rich in fruits and vegetables may reduce the risk for colon and rectal cancer. (ACS, 1998) Heavy use of alcohol and smoking may increase the risk of colorectal cancer. (NCI, 1998)

5 1,418 new cases of melanoma of the skin were reported in 1996. Melanoma accounted for 154 deaths in Washington residents. Nationally, the incidence rate of melanoma has been increasing. (Wingo et al., 1998) In Washington, the rate of new cases for 1996 is slightly lower than the rate for 1995. This does not mean that the trend in Washington is different from the national trend, as some year to year fluctuation results from factors other than changes in the true rate. Since 1992, the rate of new cases of melanoma has increased an average of approximately 5% per year. The mortality rate in Washington from 1991 to 1996 has remained constant, consistent with the national pattern.

There is evidence that avoiding sunburns, especially during childhood and adolescence, may be effective in preventing melanoma. (NCI, 1998) Although there is insufficient evidence that routine examination of the skin is effective in reducing mortality from melanoma, several instances have been noted where vigorous public and professional education programs resulted in detection of melanoma at earlier stages of disease and improved survival. (NCI, 1998) The American Cancer Society recommends skin examination by a doctor every three years for people 20 to 40 years old and every year for people older than 40 years. The American Cancer Society also recommends monthly self-examination. (ACS, 1998)

Washington State Cancer Registry

Background

In 1990, RCW 70.54.230 made cancer a reportable condition in Washington and mandated the Department of Health to establish a statewide cancer registry program. Under this mandate, the Department established the Washington State Cancer Registry (WSCR) in 1991. The registry is dedicated to fulfillment of the legislative intent "...to establish a system to accurately monitor the incidence of cancer in the state of Washington for the purposes of understanding, controlling, and reducing the occurrence of cancer in this state." Since 1994, WSCR has received funding through the Centers for Disease Control and Prevention's National Program of Central Cancer Registries. This program is designed to standardize data collection and provide information for cancer prevention and control programs at the local, state, and national levels.

Data Collection

WSCR contracted with two regional tumor registries for the collection of 1996 data. The contractors were responsible for case-finding, abstracting information on cancer cases in their respective regions, and reporting to the statewide registry. The Cancer Surveillance System (CSS) of the Fred Hutchinson Cancer Research Center provided data on cancer cases from 13 counties in Western Washington, covering the majority of the state's population including the largest urban center of Seattle. CSS has been in operation since 1974 as a participant in the Surveillance Epidemiology and End-Results (SEER) Program of the National Cancer Institute. The Walla Walla-based Blue Mountain Oncology Program (BMOP), under contract with the Department of Health, expanded the activities of its 14 facility-based registry to cover the remainder of the state. BMOP also conducts regular data exchanges with hospitals in Oregon and Idaho to gather data on Washington residents traveling across state lines for cancer diagnosis and treatment.

The contractors receive reports of cancer cases from hospitals, pathology laboratories, radiation oncology centers, ambulatory surgical centers, cancer treatment centers, and physicians. Contract staff complete data abstraction on all reported cases or collect abstracts from hospital tumor registrars who complete them. The contractors also carry out quality assurance activities and provide WSCR with data tapes on a regular basis. WSCR is responsible for merging the data and finalizing the statewide data set, overall data quality assurance in accordance with national standards, and dissemination of cancer information to assist with cancer prevention and control efforts statewide.

The cancer reporting rules (246-430 WAC) define reportable cancer cases as "any malignant neoplasm, with the exception of basal and squamous cell carcinoma of the skin". Also specifically included are: 1) basal and squamous cell carcinoma of the external genital organs (vulva, labia, clitoris, prepuce, penis, anus, scrotum); 2) all brain tumors; 3) ovarian tumors of borderline or low malignant potential and 4) cancer in situ, except cancer in situ of the uterine cervix. Required data elements for cancer reporting include demographic (such as age, sex) and medical information (such as type of cancer, data and stage at diagnosis) about all newly diagnosed cases. Copies of Washington's cancer reporting legislation and regulations are available on request.

Report Contents

This report summarizes incidence and mortality data on all cancers combined and on the 24 cancer sites most frequently diagnosed in Washington residents. The following sections briefly describe each of the tables, graphs and charts in this report; the statistical methods used to produce each table, graph or chart; and special considerations for interpreting the

data. The main body of this report consists of eight-page sections on each of the selected malignancies. Finally, appendices include technical notes and sources of information on the epidemiology and prevention of cancer.

The primary focus of the eight-page sections is on cases newly diagnosed between January 1, 1996 and December 31, 1996. This information covers the entire state and includes new cases of cancer among Washington residents diagnosed in Oregon. Mortality statistics include deaths among Washington residents which occurred in 1996 where the underlying cause of death was cancer. The cancer may have been diagnosed before 1996.

Tables, Charts and Graphs

Data Definitions and Sources

The Washington State Cancer Registry provides the number of new cases (incidence) of cancer as described above. Based on estimates of the expected number of cancer cases, the registry includes more than 95% of cases. Each cancer is coded to an International Classification of Diseases Oncology (ICD-O) code. The data definition provides the ICD-O codes used in each section. We have used definitions which are consistent with those used by the National Cancer Institute's SEER program.

The Washington State Department of Health, Center for Health Statistics provides information on the number and causes of death from death certificates. According to the National Center for Health Statistics, more than 99% of all deaths occurring in the United States are registered in the death certificate system. Accuracy of reporting specific causes of death varies since classification of disease conditions is a medical-legal opinion subject to the best information available to the physician, medical examiner, or coroner certifying the cause of death. We obtained the number of cancer deaths from the Vital Registration System Annual Statistical Files, Washington State Deaths 1980-1996 CD-ROM issued October 1997.

The underlying cause of death is coded to an International Classification of Diseases, 9th Revision (ICD-9) code. The data definition provides the ICD-9 codes used in each section. We have used definitions which are consistent with those used by the SEER program. **For some cancer sites, including colorectal, liver, breast, and multiple myeloma, the SEER coding differs from the National Center for Health Statistics coding which may be used in other Department of Health reports.** Therefore, before comparing information from different reports, one must be sure that the definitions are consistent.

We obtained population estimates necessary for the calculation of rates from the Washington State Department of Social and Health Services, Research and Data Analysis. These estimates, called Washington State adjusted population estimates, were released in June 1997 and are based on estimates by Claritas, Inc. and the Washington State Office of Financial Management. Minor differences at the state and county level between these population estimates and those released by the Office of Financial Management in January, 1997, are due to rounding.

Incidence and Mortality Summary

These tables provide the number of new cases and the number of deaths for Washington State residents in 1996. Since the numbers of new cases and deaths depend, in part, on the size of the population, we converted numbers to rates (e.g., the number of cases per 100,000 people) so that they may be compared among different regions or populations. For diseases, such as cancer, where incidence varies with age, the rates are usually age-adjusted to minimize the effect of differing age distributions when comparing two geographic regions or populations.

Following National Cancer Institute guidelines, we have adjusted rates per 100,000 population for Washington residents to the US 1970 standard population. **When making comparisons, one must be careful to compare age-adjusted rates which are adjusted to the same standard population.** Additionally, age-adjusted rates should not be compared to rates which are not age-adjusted (i.e., crude rates). More detail on our age-adjustment method is provided in Appendix A.

The final row of the Incidence table provides age-adjusted incidence rates from the nine National Cancer Institute's SEER regions. These rates are from the SEER Stat Windows for 95 version 1.1 CD-ROM. The final row of the Mortality table provides age-adjusted mortality rates for the United States. The US mortality data were obtained from the CDC WONDER program (http://wonder.cdc.gov/). Please note that the 1996 SEER and national data are not yet available. Since cancer incidence and mortality rates do not change rapidly, we have provided **1995** SEER incidence data and **1995** national mortality data for comparison.

Stage at Diagnosis

Stage at diagnosis refers to how far a cancer has spread from its site of origin when it is diagnosed. The stages, in order of increasing spread, are in situ, local, regional and distant. Cancers staged as local, regional, or distant are referred to as invasive. The WSCR data contain the stage of disease at diagnosis coded according to the SEER guidelines.

In Situ	A tumor that fulfills all microscopic criteria for malignancy, but does not invade or penetrate surrounding tissue.
Localized	A tumor that is invasive but remains restricted to the organ of origin.
Regional	A tumor that has spread by direct extension to immediately adjacent organs or tissues and/or metastasized (spread through the blood stream) to regional lymph nodes, but appears to have spread no further.
Distant	A tumor that has spread by direct extension beyond the immediately adjacent organs or tissues, and/or metastasized to distant lymph nodes or other distant tissues.
Unstaged	Insufficient information available to determine the stage of disease at diagnosis.

We have provided the frequency distribution of cases according to their stage at diagnosis.

For most cancers, diagnosis at an early stage (in situ or local) results in improved survival. One standard measure of survival is the five-year survival rate which estimates the proportion of individuals with a given cancer remaining alive five years after diagnosis. Due to the relative newness of WSCR, we have not developed five-year survival rates for Washington state residents. However, we have provided the SEER five-year survival rate for each cancer. These statistics were obtained from the SEER CANQUES program (http://www.seer.ims.nci.nih.gov/ScientificSystems/ Canques7395/) and provide survival rates both for all invasive stages combined (local, regional and distant) and for local stage at diagnosis. The five-year relative survival rates are estimated for cases diagnosed between 1989 and 1994 based on follow-up of patients through 1995.

Age-Specific Incidence Rates

Age-specific rates show the variation in cancer incidence by age group for males, females, and the total population.

Incidence and Mortality Rate Trends

These charts provide incidence and mortality rates for several years for Washington residents per 100,000 population, age-adjusted to the US 1970 standard population. (See "Incidence and Mortality Summary" for a discussion of age-adjusted rates.) These tables show both how the rates vary over time and the relationship between cancer incidence and mortality. However, given only four years of incidence data, one needs to be cautious in interpreting the trends for cancer incidence. As more years of data accrue, this type of information will become increasingly helpful in determining whether incidence is increasing, decreasing, or remaining constant.

Incidence and Mortality Rates by PUMS Regions

The Public Use Micro-Data Set (PUMS) regions, were developed by the state Office of Financial Management in collaboration with the United States Census Bureau. Each PUMS region had a minimum population of 100,000 in 1990. Under this scheme, the state's nine largest counties are considered individually. The remaining counties are grouped in order to maintain, to the extent possible, cultural and socio-economic similarity within regions. The regions are listed below.

Region 1	Whatcom
Region 2	Island, San Juan, Skagit
Region 3	Chelan, Douglas, Kittitas, Okanogan
Region 4	Kitsap
Region 5	Clallam, Jefferson, Mason
Region 6	Snohomish
Region 7	King
Region 8	Pierce
Region 9	Thurston
Region 10	Grays Harbor, Lewis, Pacific
Region 11	Clark
Region 12	Cowlitz, Klickitat, Skamania, Wahkiakum
Region 13	Adams, Ferry, Grant, Lincoln, Pend Oreille, Stevens
Region 14	Spokane
Region 15	Benton, Franklin
Region 16	Yakima
Region 17	Asotin, Columbia, Garfield, Walla Walla, Whitman

We have presented age-adjusted 1996 cancer incidence and mortality rates for Washington residents per 100,000 population by PUMS regions. (See "Incidence and Mortality Summary" for a discussion of age-adjusted rates.) The state rates and 95% confidence intervals are included for comparison purposes. While the incidence and death statistics in this report are not subject to sampling error, they may be affected by random variation. The confidence interval is used to describe the range of that variation.

Generally, when the confidence interval for the area of interest does not overlap with the confidence interval for the comparison area, we say that the two areas are statistically significantly different, i.e., the difference between the two rates is more than that expected by random variation or chance. However, if we are making many comparisons, we may still find what appear to be statistically significant differences just by chance. In fact, with a 95% confidence interval, we expect that 5% of the comparisons will appear to be statistically significant by chance. Thus, with 17 PUMS regions and 24 cancer sites, we would expect to see about 20 instances where the rate for a PUMS region appeared to be statistically significantly different from the state rate just by chance.

Because the rate is not stable (i.e., it may fluctuate widely from year to year) when there are a small number of cases, the rate and confidence intervals are omitted when there are fewer than 5 cases. Details of our methods for calculating confidence intervals are in Appendix A.

Incidence and Mortality Rates by County

These statistics are presented in a similar manner to those for the PUMS regions. However, because of the small size of many counties and the relative rarity of some types of cancer, we are unable to compute a stable rate due to the small number of cases for many of the counties when we use only one year of data. Therefore, we have combined three years of data (1994-1996) and computed annual average age-adjusted rates. (See section “Incidence and Mortality by PUMS Regions” for technical details and notes on interpretation.)

Data Tables

Each section ends with three pages of detailed tables. These tables provide statistics by county and PUMS region. The county table provides the number of new cases and the average annual number of deaths for 1994-1996. The table also includes incidence and mortality rates with the 95% confidence interval, age-adjusted to both the 1940 and 1970 US standard populations. (See “Incidence and Mortality Summary” for a discussion of age-adjusted rates. See “Incidence and Mortality Rates by PUMS Regions” for a discussion of confidence intervals.) Age-adjustment using these standards is included so that the rates are comparable to those from the National Cancer Institute, which adjusts to the 1970 US standard population and to those from the National Center for Health Statistics at CDC which generally adjust to the 1940 US standard population. However, caution must be used in making comparisons among different sources, since coding of cancer sites varies. In particular, we have noted that the National Cancer Institute and the National Center for Health Statistics use different codes for colorectal, liver, breast, and multiple myeloma.

The tables for the PUMS regions include the same information as the county tables, except that these statistics are for only 1996. They also include figures for males and females separately.

What’s Missing

Race Groupings

The cancer reporting rules require that the race of each case be included in the data provided to WSCR. However, special studies linking Indian Health Services data to WSCR have revealed that Native Americans are often reported as Caucasians and are, therefore, underreported in WSCR. For people who died between 1992 and 1996, we compared reporting of race and ethnicity on the death certificate and in WSCR. Racial classification agreed in the two sources for 98.6% of the records. However, there were marked

differences by race. Approximately 99% of those recorded as white, 97% of those recorded as black, and 94% of those recorded as Asians (including Pacific Islanders) on the death certificate were recorded as such in WSCR. However, only approximately 70% of people recorded as American Indians and Native Alaskans on the death certificate were recorded as such in WSCR. For Hispanic ethnicity, the agreement between the death certificate and WSCR was 99.3%. Using the death certificate as the standard, 99.5% of non-Hispanics were accurately recorded in WSCR. However, only 74.6% of Hispanics were recorded as such in WSCR. We will continue to assess the accuracy of reporting of race and ethnicity with the goal of including this information in subsequent WSCR reports.

Information on Prevention, Early Detection, and Treatment

Illness and death due to cancer are increasingly preventable through the application of growing knowledge about the causes of cancer, improved screening, and early diagnosis techniques, and more effective treatment. Extensive information on prevention though changing modifiable risk factors, early detection through routine screening, and preferred treatment modalities is available. We have not attempted to reproduce this information in detail. However, a brief summary of the most important public health aspects of cancer prevention and control follows in the paragraphs below. We have provided a resource list in Appendix B for those interested in more detail.

Screening for early detection has a clear role in reducing the disease burden due to cancer of the female breast, the uterine cervix, and colorectal cancer (NCI, 1998). There is also evidence that routine examination of the skin is effective in reducing mortality from melanoma. (NCI, 1998) Inspection of the oral cavity by dentists and physicians may help identify oral cancers at earlier, more treatable stages. (NCI 1998)

Major reductions in cancer rates, and in an individual's likelihood of developing cancer, are achievable through primary prevention strategies. The elimination of tobacco use would markedly reduce the incidence of lung cancer and reduce the incidences of cancer of the oral cavity and pharynx, esophagus, bladder, kidney, pancreas, colon, and rectum. (Schottenfeld and Fraumeni, 1996; NCI, 1998) Cancers of other sites, especially those of squamous cells, such as squamous cell cancer of the uterine cervix, may also be reduced by elimination of tobacco use. (Schottenfeld and Fraumeni, 1996). A diet low in fat, high in fiber and including five or more servings per day of fruits and vegetables is likely to reduce the risk for cancer of the colon and rectum, oral cavity, esophagus, and stomach (Schottenfeld and Fraumeni, 1996) and possibly reduce the risk of breast cancer (NCI, 1998). Additional studies have shown beneficial effects of a diet rich in fruits and vegetables for prevention of cancer at other sites, such as uterine cervix, ovary, endometrium, lung, larynx, and other organs, but the scientific literature for these sites is not as extensive and/or consistent as for the sites previously listed. (Schottenfeld and Fraumeni, 1996) Regular, moderate exercise has also been shown to have some benefit in the prevention of cancer at a number of sites, such as colorectal and breast (NCI, 1998). The overall health benefit of these habits, and their lack of countervailing risk, makes them wise choices for cancer prevention. Health care providers, public health agencies, and voluntary organizations can provide the education which helps people make healthy choices.

While individual behavior plays an important role in cancer prevention, governmental and other societal entities have key roles as well. Policies and regulations that, for example, ban cigarette smoking, reduce youth access to tobacco, assure delivery of health services and control occupational exposures are important for preventing and controlling cancer.

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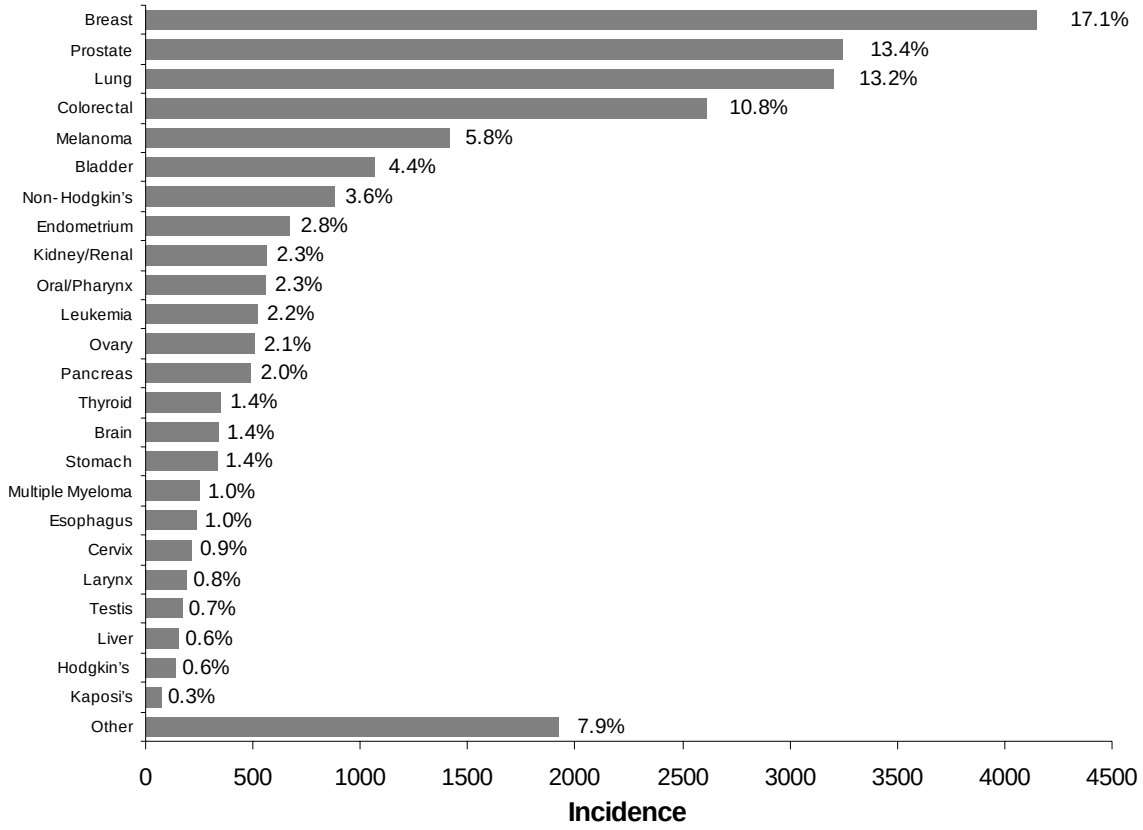
Percent Distribution of Cancer

1996 Total Cancer Incidence of Washington State Residents



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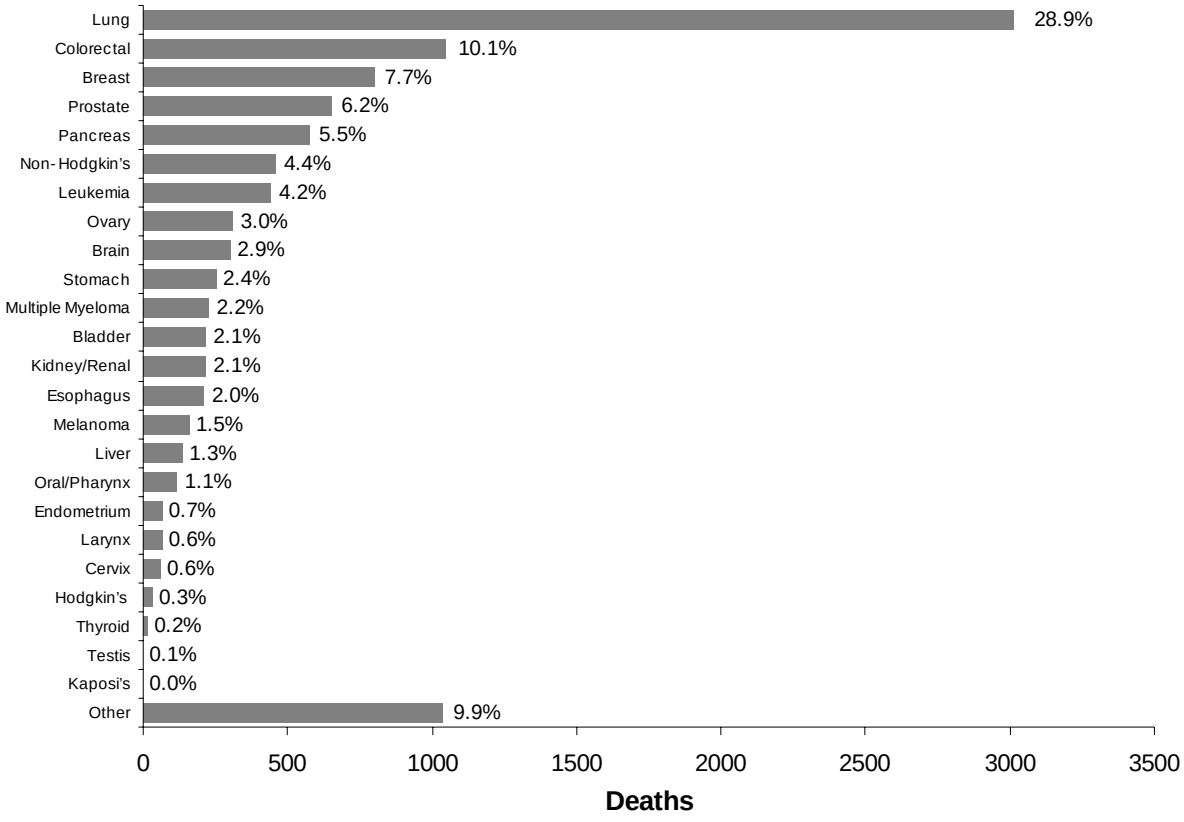
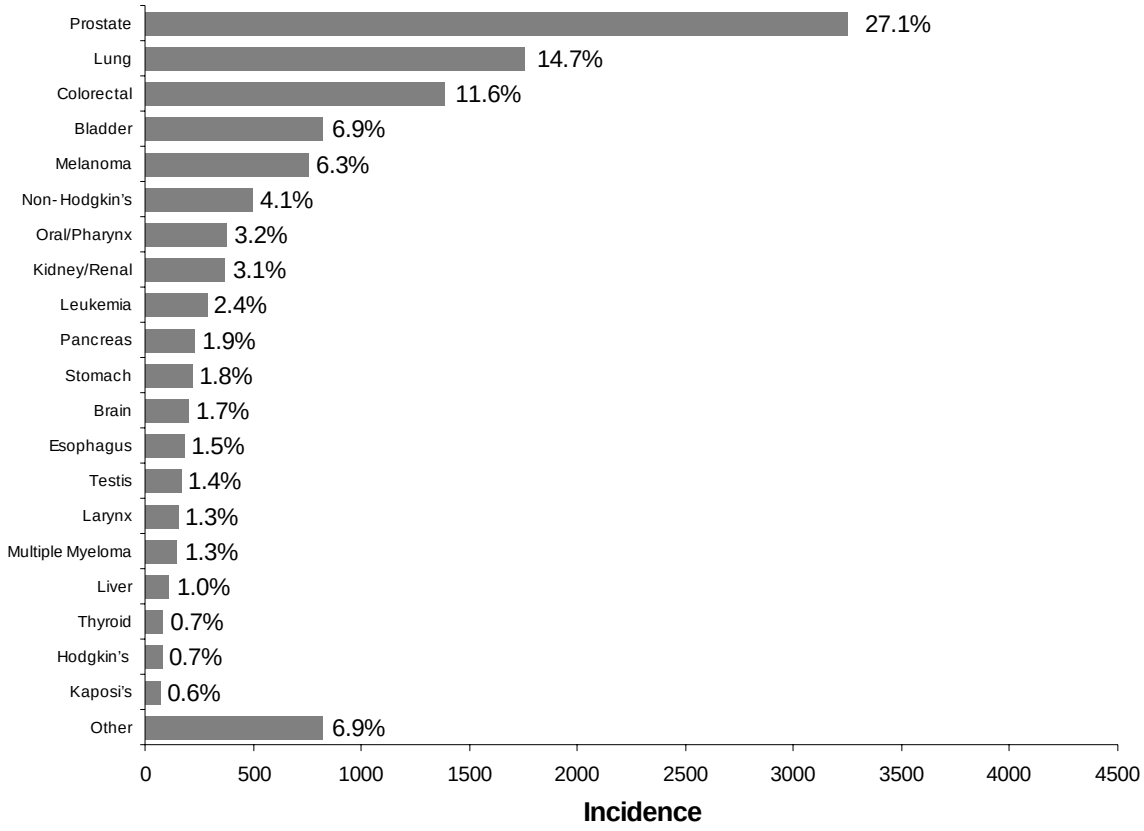
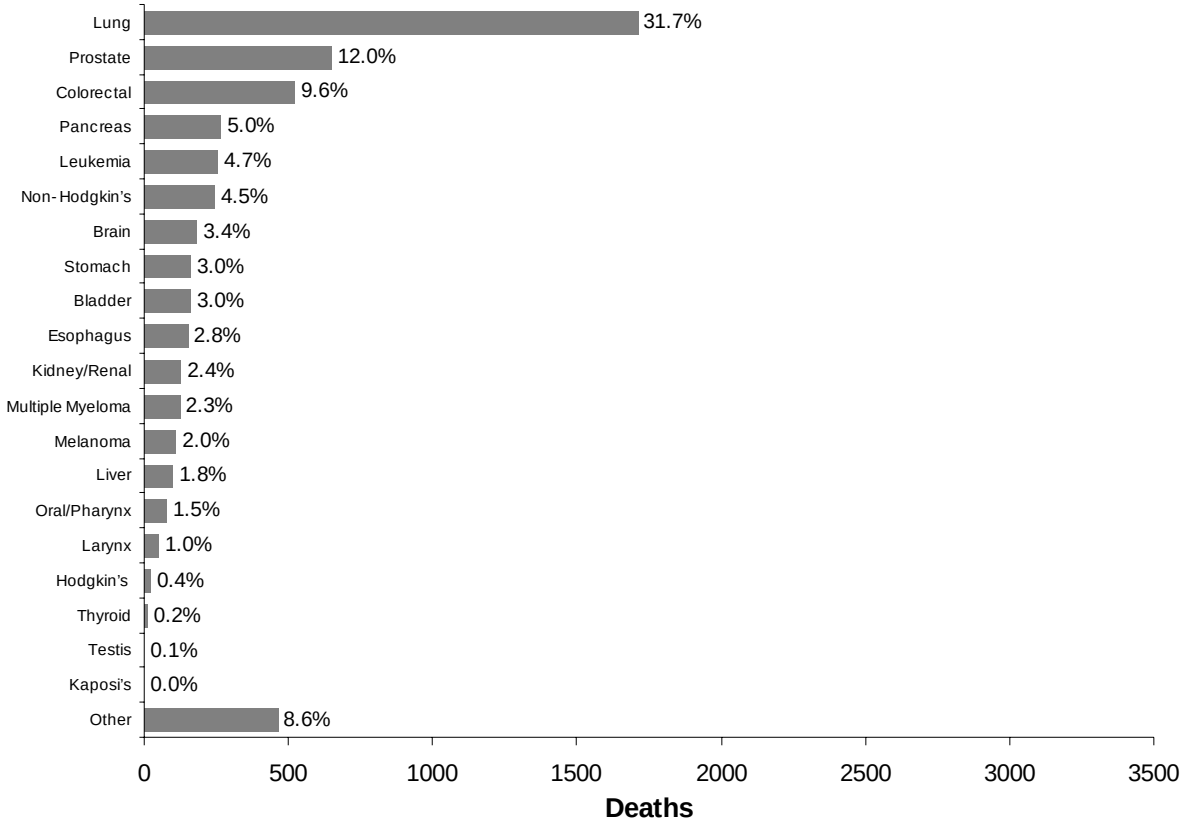


Percent Distribution of Cancer

1996 Male Cancer Incidence of Washington State Residents

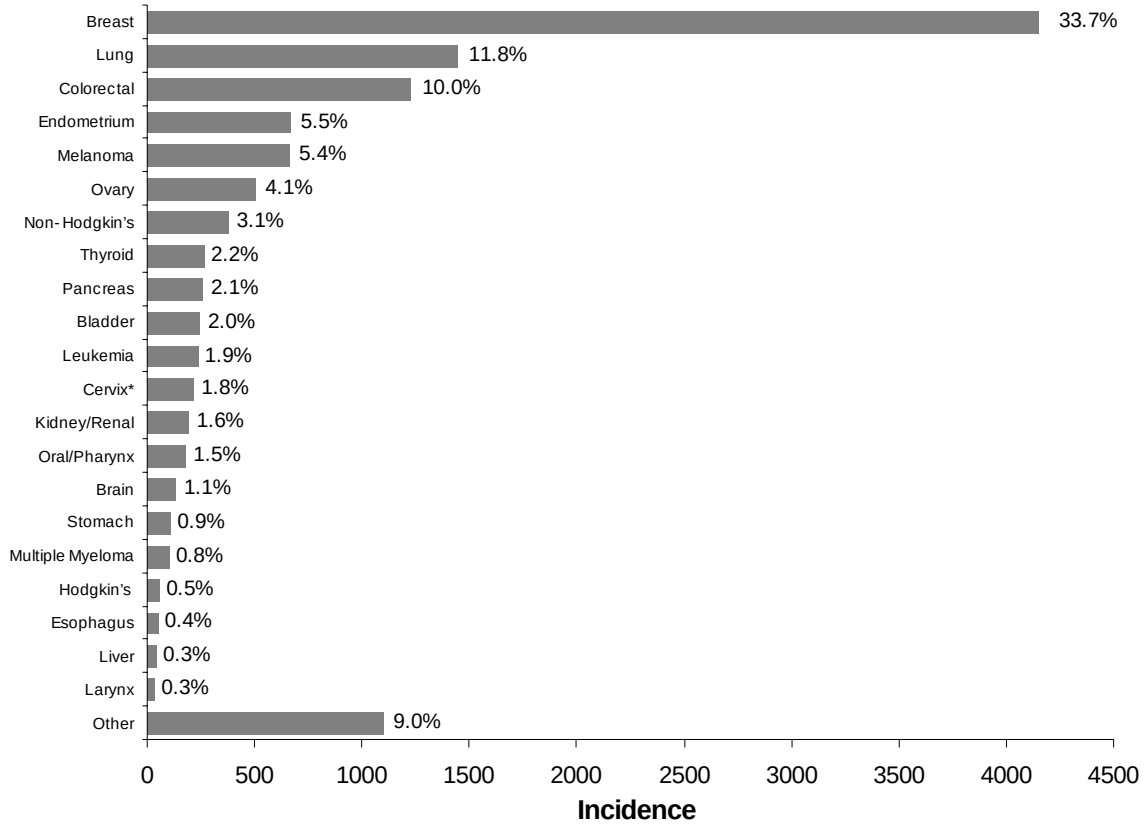


1996 Male Cancer Deaths of Washington State Residents

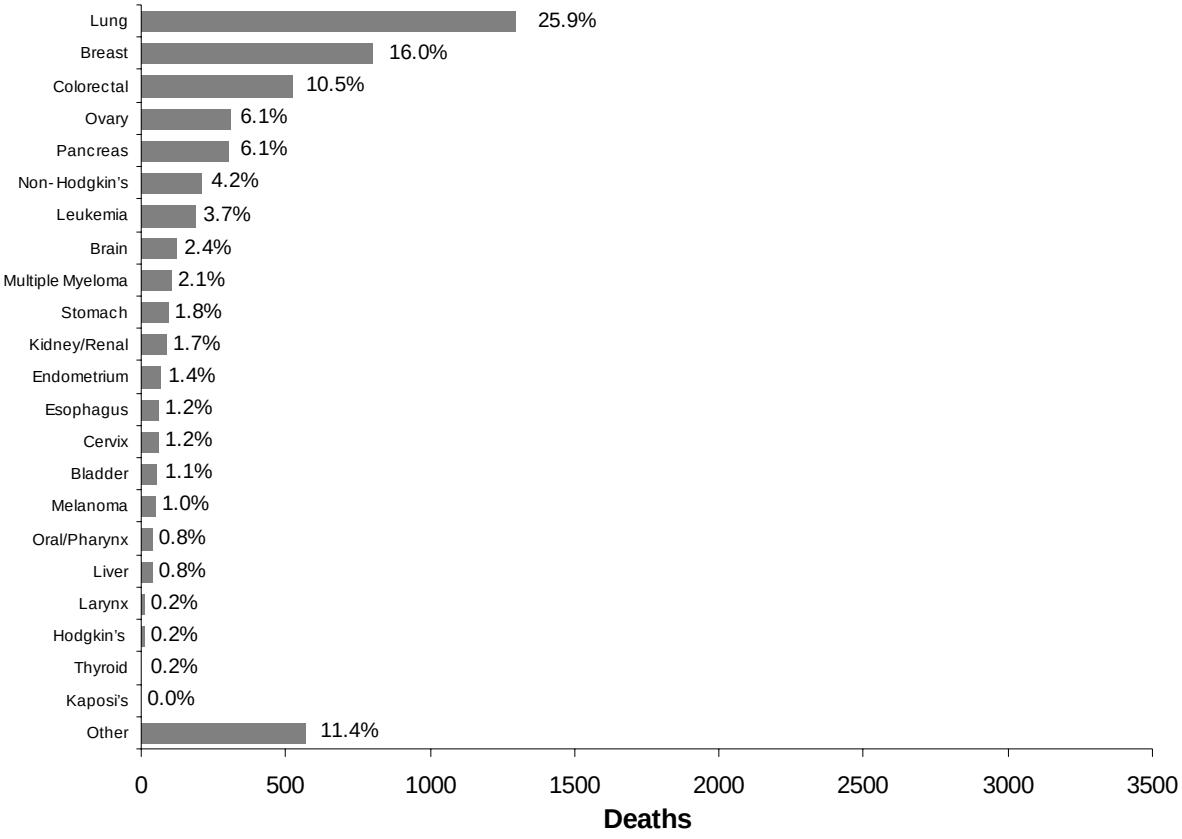


Percent Distribution of Cancer

1996 Female Cancer Incidence of Washington State Residents



1996 Female Cancer Deaths of Washington State Residents



Appendices

Appendix A: Technical Notes

Age-Adjustment

Age-adjusted incidence rates were developed using the direct method. They were standardized to the age distribution of the United States 1970 and 1940 populations. Following the age-adjustment procedures used by the National Cancer Institute, which uses the US 1970 standard population for age-adjustment, we used five year age groups in calculating age-adjusted rates with the 1970 US standard population. For age-adjustment with the 1940 US standard population, we followed the methods of the National Center for Health Statistics which uses 10 year age groups from age 5 through 85. The age distributions of the US standard populations are shown below.

US Standard Population Proportions

1970		1940	
age group	proportion	age group	proportion
0 - 4	0.0844	<1	0.0160
5 - 9	0.0982	1 - 4	0.0641
10 - 14	0.1023	5 - 14	0.1703
15 - 19	0.0938	15 - 24	0.1817
20 - 24	0.0806	25 - 34	0.1621
25 - 29	0.0663	35 - 44	0.1392
30 - 34	0.0562	45 - 54	0.1178
35 - 39	0.0547	55 - 64	0.0803
40 - 44	0.0590	65 - 74	0.0484
45 - 49	0.0596	75 - 84	0.0173
50 - 54	0.0546	85+	0.0028
55 - 59	0.0491		
60 - 64	0.0424		
65 - 69	0.0344		
70 - 74	0.0268		
75 - 79	0.0189		
80 - 84	0.0112		
85+	0.0074		

Direct method of age adjustment

Multiply the age-specific rates in the target population by the age distribution of the standard population.

$$\hat{R} = \sum_{i=1}^{m} s_i (d_i / P_i) \; = \sum_{i=1}^{m} w_i d_i$$

Where m is the number of age groups, d_i is the number of deaths in age group i, P_i is the population in age group i, and s_i is the proportion of the standard population in age group i. This is a weighted sum of Poisson random variables, with the weights being $\left(s_i / P_i\right)$.

Confidence Intervals

Confidence intervals for the age-adjusted rates were calculated with a method based on the gamma distribution (Fay and Feuer, 1997). This method produces valid confidence intervals even when the number of cases is very small. When the number of cases is large the confidence intervals produced with the gamma method are equivalent to those produced with the more traditional methods, as described by Chiang (1961) and Brillinger (1986). The formulas for computing the confidence intervals are given below. Although the derivation of this method is based on the gamma distribution, the relationship between the gamma and Chi-squared distributions allows the formulas to be expressed in terms of quantiles of the Chi-squared distribution, which can be more convenient for computation.

$$\text{Lower Limit} = \frac{v}{2y}\left(\chi^2\right)^{-1}_{\frac{2y^2}{v}}(\alpha/2)$$

$$\text{Upper Limit} = \frac{v + w_M^2}{2(y + w_M)}\left(\chi^2\right)^{-1}_{\frac{2(y+w_M)^2}{v+w_M^2}}(1-\alpha/2)$$

where y is the age-adjusted death rate, v is the variance as calculated as shown below, w_M is the maximum of the weights $s_i P_i$, $1-\alpha$ is the confidence level desired (e.g., for 95% confidence intervals, α = 0.05), and $\left(\chi^2\right)^{-1}_x$ is the inverse of the χ^2 distribution with x degrees of freedom.

$$v = \sum_{i=1}^{m} d_i\left(s_i/P_i\right)^2$$

References

Brillinger, D. R. The natural variability of vital rates and associated statistics [with discussion]. *Biometrics* 42:693-734, 1986.

Chiang, C. L. Standard error of the age-adjusted death rate. *Vital Statistics, Special Reports* 47:271-285, USDHEW, 1961.

Fay, M.P. and Feuer, E.J. Confidence intervals for directly rates: a method based on the gamma distribution. *Stat Med* 16:791-801, 1997

Appendix B: Sources of Additional Information

For more information on cancer, risk factors or prevention strategies please refer to the following resources:

1-800-4CANCER: A cancer information service of the National Cancer Institute

American Cancer Society, Western-Pacific Division: 1-800-729-1151 ext. 3307
American Cancer Society. 1998 Cancer Facts and Figures
American Cancer Society website, http://www.cancer.org/frames.html

National Cancer Institute. PDQ Detection and Prevention Website
http://icicc.nci.nih.gov/clinpdq/screening.html

Schottenfeld, David and Fraumeni, Joseph F. Jr. Cancer Epidemiology and Prevention, Second Ed. Oxford University Press, 1996.

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Appendix C: Advisory Council Members

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